MEDC – Cluster Activities

House New Economy & Quality of Life Committee
Honorable Rep. Ed Clemente, Chair
July 19, 2007

Cluster vs. Sector

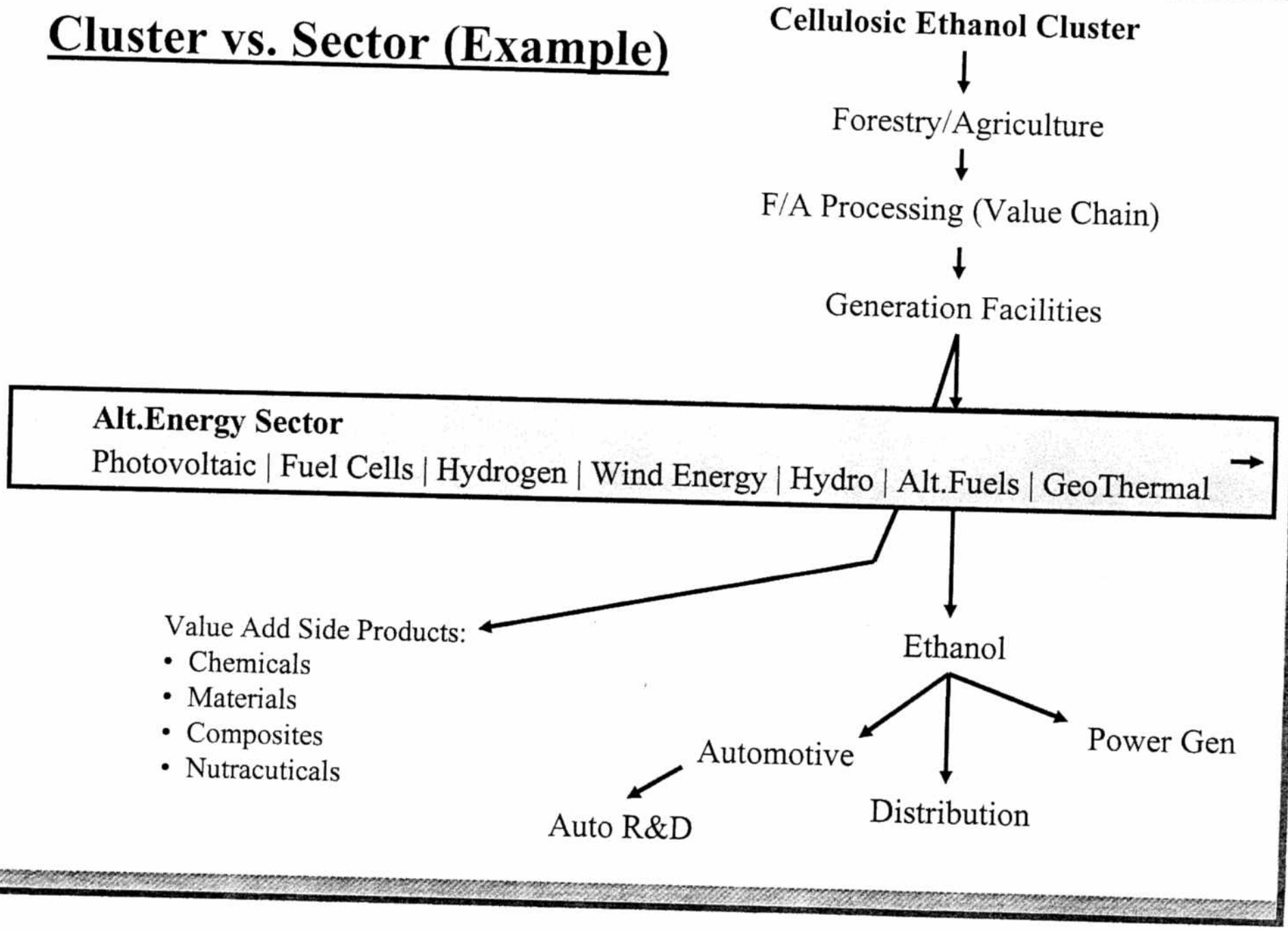
Sector Characteristics:

- Broad industry based (NAICS/SICS)
- Sectors are a single slice through the economy

Cluster Characteristics:

- Geographic concentrations
- Both competitive and cooperative – may be direct competitors or suppliers (or both)
- Includes multiple industry classifications and up/down supply chain
- Common economic infrastructure needs:
  - Talent/Workforce (including training and skill sets)
  - Technology
  - Financing
  - Infrastructure (telecomm, physical, quality of life)
  - *Economic Development policies, programs, initiatives and regulatory*

Cluster vs. Sector (Example)



MEDC Cluster Targeting

What Constitutes MEDC Targeted Clusters:

- Natural Resources / Infrastructure
- Industrial Strength or Intensity
- Innovation / R&D
- Special Assets
- GAP!

Targeted Initial Clusters:

- Cellulosic Biofuels
- Medical Device / Health Tech
- Wind Energy
- Photovoltaic
- Advanced Energy Storage

Cluster Structure

- Significant initial and ongoing research activities (over 3000 hours)
- Collaborative team (advisory group)
  - Industry
  - University specialists
  - Associations or external groups
  - Appropriate State agencies
  - Economic development local partners (as appropriate)
- Examples of output
  - Policy and incentive recommendations
  - Attraction targets and strategies
  - Collaborative recommendations
  - Targeted 21st Century or other state programs

Important Note: Expected variation between clusters.

Health Industry - Medical Technology

- **Definition:** Focus on companies that develop, manufacture and market medial devices, imaging and diagnostic products that require FDA approval, and technologies that increase efficiencies and reduce healthcare costs
- **Market Size:** $220 Billion world-wide industry ($86 Billion in U.S.). 10% annual growth rate expected in 2007
- **Top MI Companies:** Stryker, Delphi Medical, Pioneer Surgical, etc.
- **Competitors**: Germany, Japan, Netherlands, California, New York, Massachusetts, Minnesota, Illinois, Florida, Pennsylvania, Texas, Wisconsin
- **MI Profile**: $3 billion in sales, 200+ companies, most fewer than 50 employees
- **Michigan's Advantage**: Industrial experience in precision-based advanced manufacturing and talent

Advanced Energy Storage

- **Definition:** Next generation of advanced batteries (non lead-acid) with primary focus on transportation sector
- **Market Size:** $600 million hybrid-electric vehicle market. Market dominated by Japan. Total battery market expected to hit $74 billion in 2010
- **Top MI Companies:** Cobasys, Compact Power, A123, Harding Energy, Johnson Controls, Exide and Delphi, etc.
- **Michigan's Competitive Advantages:**
  - Proximity to OEM's
  - Existing companies – leadership in NiMH and Lithium Ion batteries
  - Automotive industry acts as a magnet for R&D

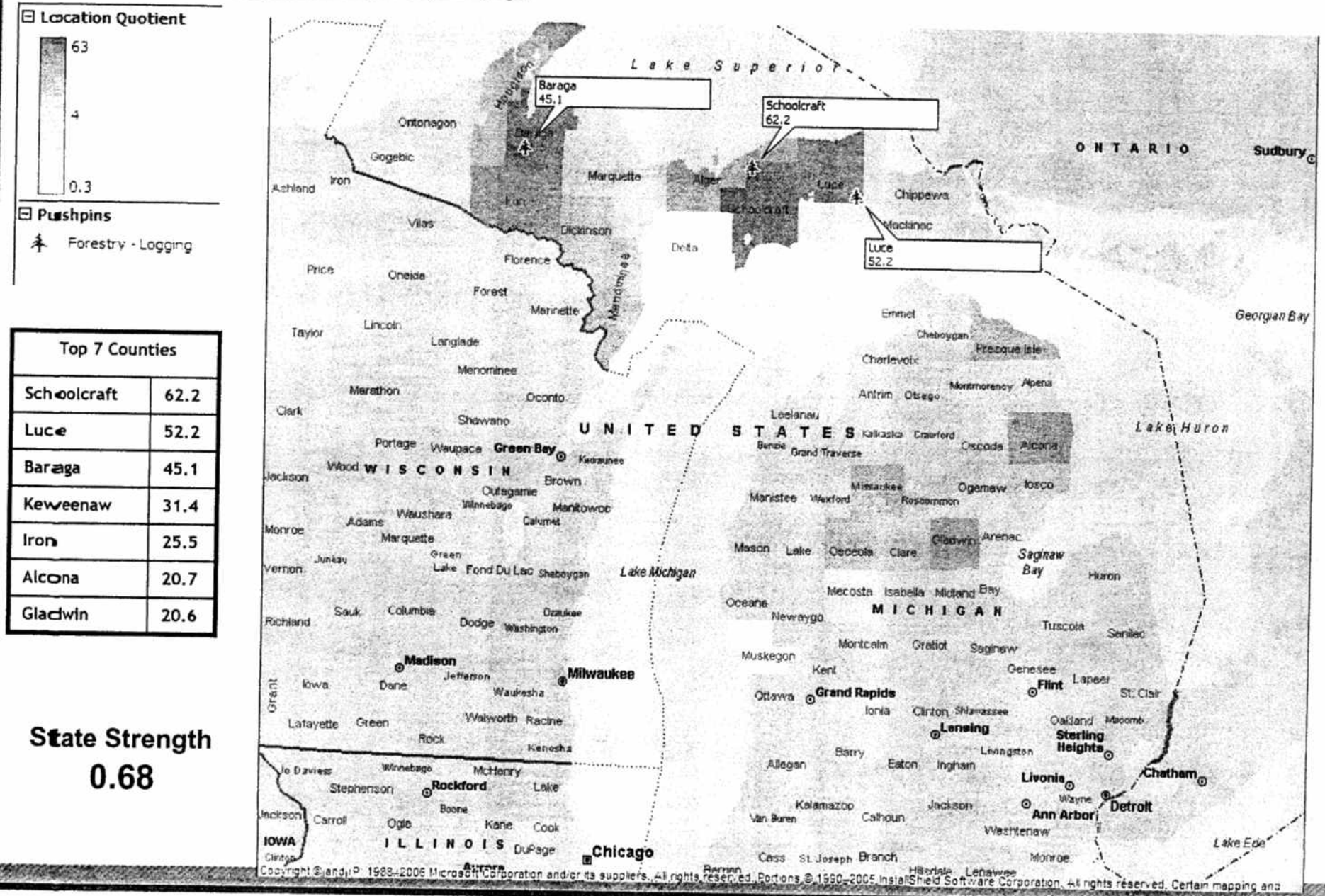
Photovoltaic (Solar)

- **Definition:** Focus on companies that manufacture PV products
- **Market Size:** Global Sales = $7.6 Billion (2004), expecting 15-20% growth per year
- **Top MI Companies:** Energy Conversion Devices, United Solar Ovonics (Uni-Solar), Hemlock Semiconductor (worlds largest producer of Polycrystalline)
- **Competitors:** Germany (one of the world leaders), Japan, possibly SW U.S.
- **MI Advantages:** Anchor Companies

Cellulosic BioFuel

- **Definition:** Chemicals or Fuel produced from various biomass sources. Opportunity for MI is to use wood based feedstocks as a biomass to create Cellulosic Biofuels.
- **Competitors:**
  - Canada, Spain, Sweden, Japan
  - New York, Iowa, California, Florida, Idaho, Georgia, Kansas (Recent DOE awards), and Tennessee
- **MI Advantages:** Strong forestry product & infrastructure (at risk), leading edge universities (MSU, MTU)

Forestry - Intensity



Top 7 Counties	
Schoolcraft	62.2
Luce	52.2
Baraga	45.1
Keweenaw	31.4
Iron	25.5
Alcona	20.7
Gladwin	20.6

State Strength
0.68

Cellulosic BioFuel Cluster Efforts to Date

- Statewide introductory meetings
- Research efforts identifying major industry players
- Formed team members with first meeting on April 20th
- Strategy and output from the April 20th
  - Federal Grant
  - Industry Partner
- Follow up meeting on June 15th

- Attraction effort and success!

Wind Energy

- **Definition:** Focus on companies engaged in the manufacturing of wind energy systems (turbines) with the understanding that this is strongly tied to wind power market opportunities

- **Market Size**: Fast growing US market – broke $3 billion in 2005, expected to grow to $7.5 billion by 2010. (2005 - all wind turbine vendors in North America sold-out of product)

- **Key Competitors:** Europe and India, North Dakota (Generation), Iowa, Pennsylvania, Ohio, California and Texas

- **Michigan's Advantages:** Available wind along coastline, manufacturing capability. Both must co-exist to maximize opportunity

Wind Energy – Opportunity Summary

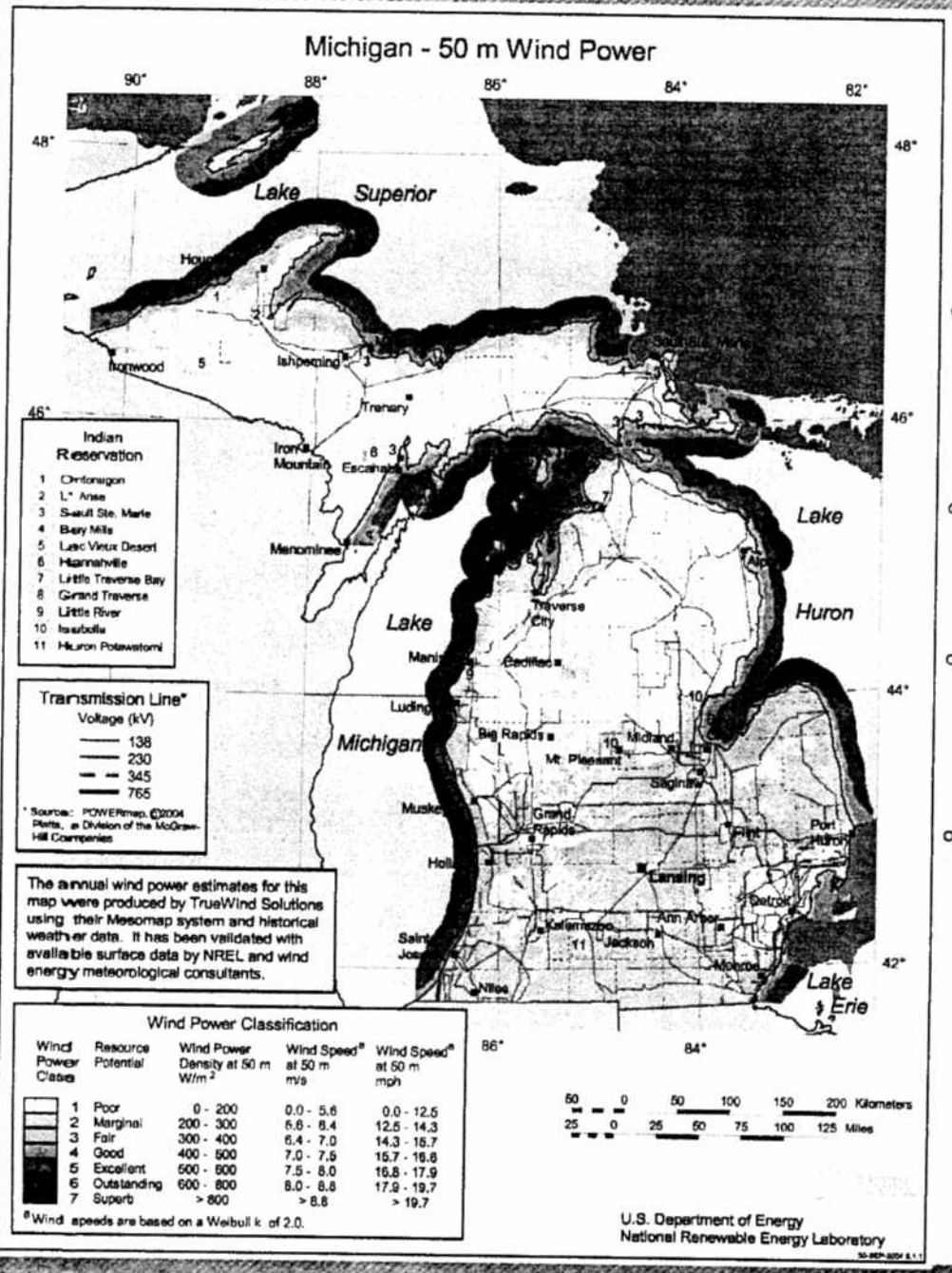
- Michigan ranks 14th in overall wind generation capacity
- Michigan ranks 4th in economic potential from wind energy system manufacturing
- Stacking these averages, Michigan ranks 2nd to 4th in overall opportunity
- Strong Manufacturing expertise with existing Michigan supply chain
- Cluster feedback is that a Renewable Portfolio Standard is the required first step

Wind Energy Cluster Efforts to Date

- Statewide introductory meetings
- Formed team members with first meeting on June 13th. Second meeting scheduled for August 15th
- Extensive research
  - Review of other state policies and programs
  - Wind manufacturing
    - World wide supply chain
    - Wind system component breakdown
    - Attraction strategies
    - Further refinement of Michigan company opportunities
- June 13th meeting established strategy and outputs

Wind Energy Cluster Outputs

- Manufacturing
  - Attraction
  - Existing Michigan suppliers and opportunities
- Offshore review and analysis
- Wind power generation policy
  - Review of other states programs and policies
  - Focus on interconnection, net metering, siting issues, local gov't, etc.
  - Small wind efforts
- Education and marketing
  - Wind fact sheet
  - Company directory and education piece
  - September wind conference
- Wind Original Equipment Manufacturer Attraction Strategy
  - Possible RFP and/or specific targeting
  - Incentive package
  - Demand/order analysis
- DLEG's State Wind Outreach Team – Not directly part of cluster, but will be an important aspect

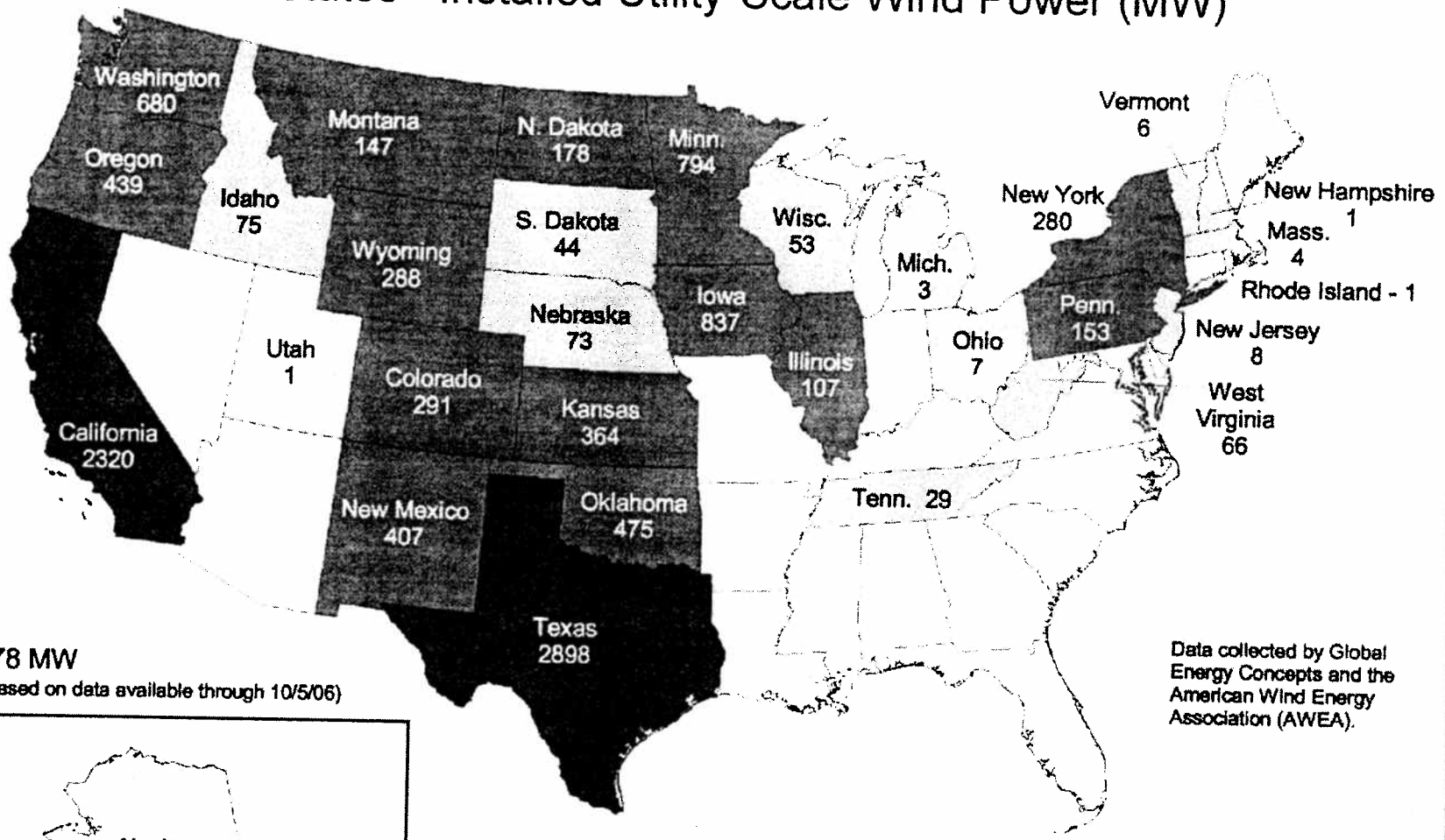


Michigan Wind Potential Average Annual

- Onshore utility-scale wind resources in Michigan are concentrated along the immediate shores of the Great Lakes
- The Great Lakes have good-to-outstanding wind resource.
- A large area of Class 3 resource is located northeast of Saginaw.
- Given the advances in wind energy technology, a number of locations in Class 3 areas may be suitable for utility-scale wind development.

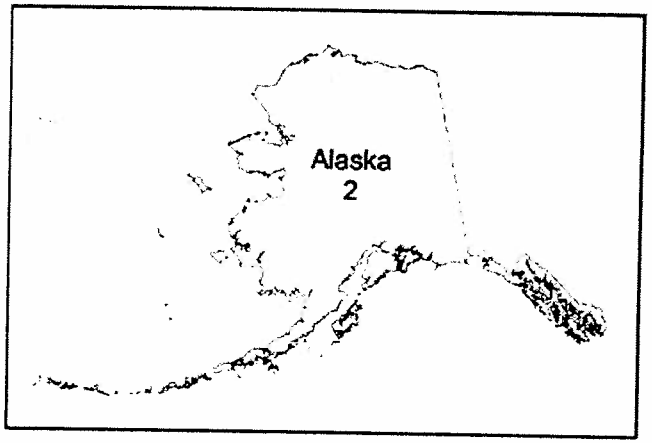
Source: US D.O.E Energy Efficiency and Renewable Energy
http://www.eere.energy.gov/windandhydro/windpoweringamerica/maps_template.asp?stateab=mi

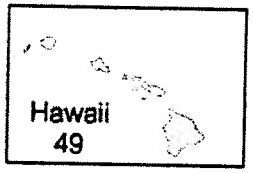
United States - Installed Utility-Scale Wind Power (MW)

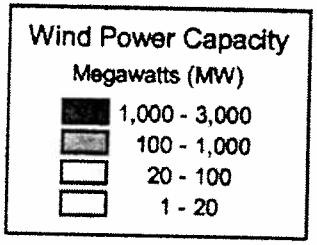


Total: 11,078 MW

(As of 9/30/06, based on data available through 10/5/06)







Data collected by Global Energy Concepts and the American Wind Energy Association (AWEA).

U.S. Department of Energy
National Renewable Energy Laboratory

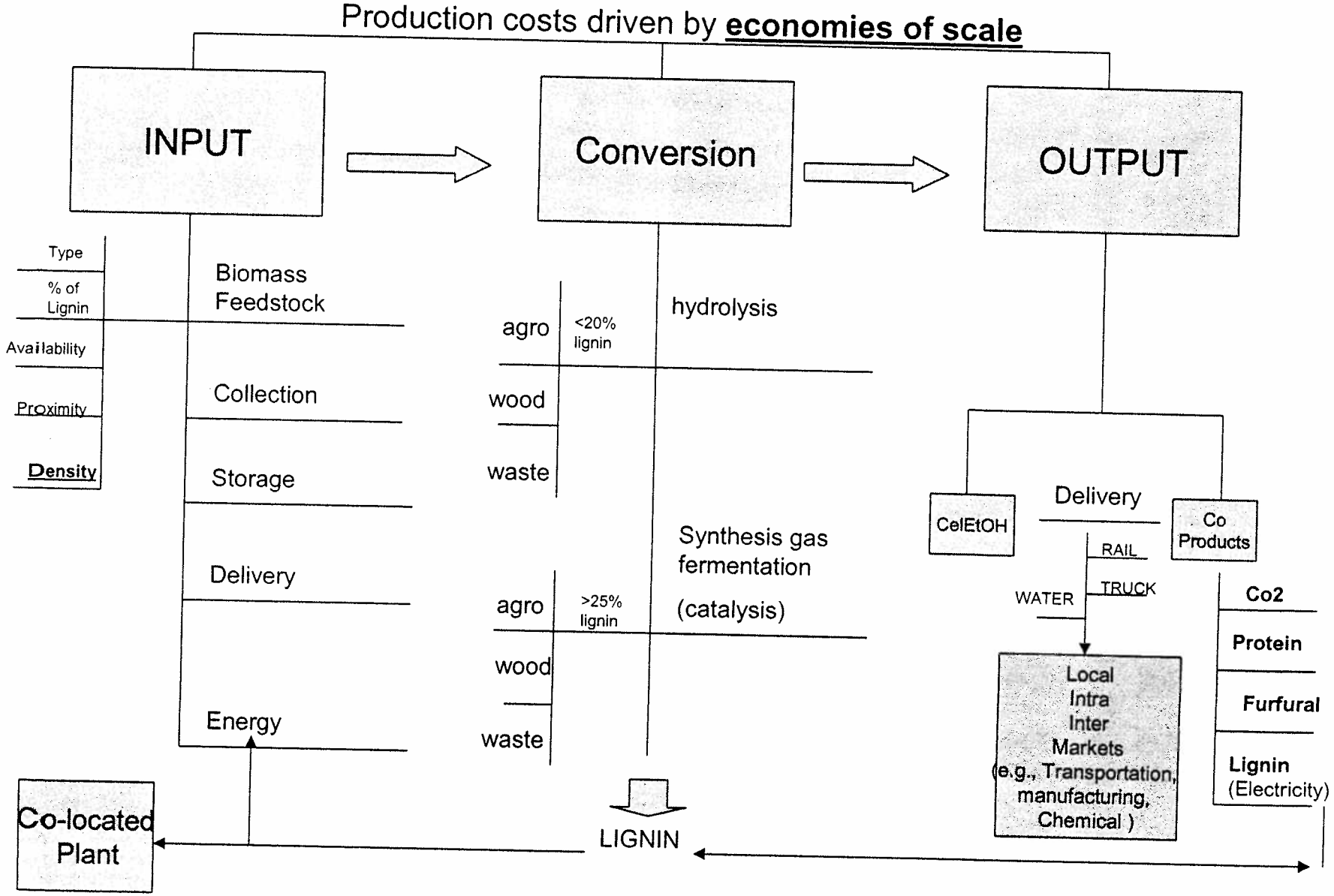
20-NOV-2006 1.1.23

Cluster Overview

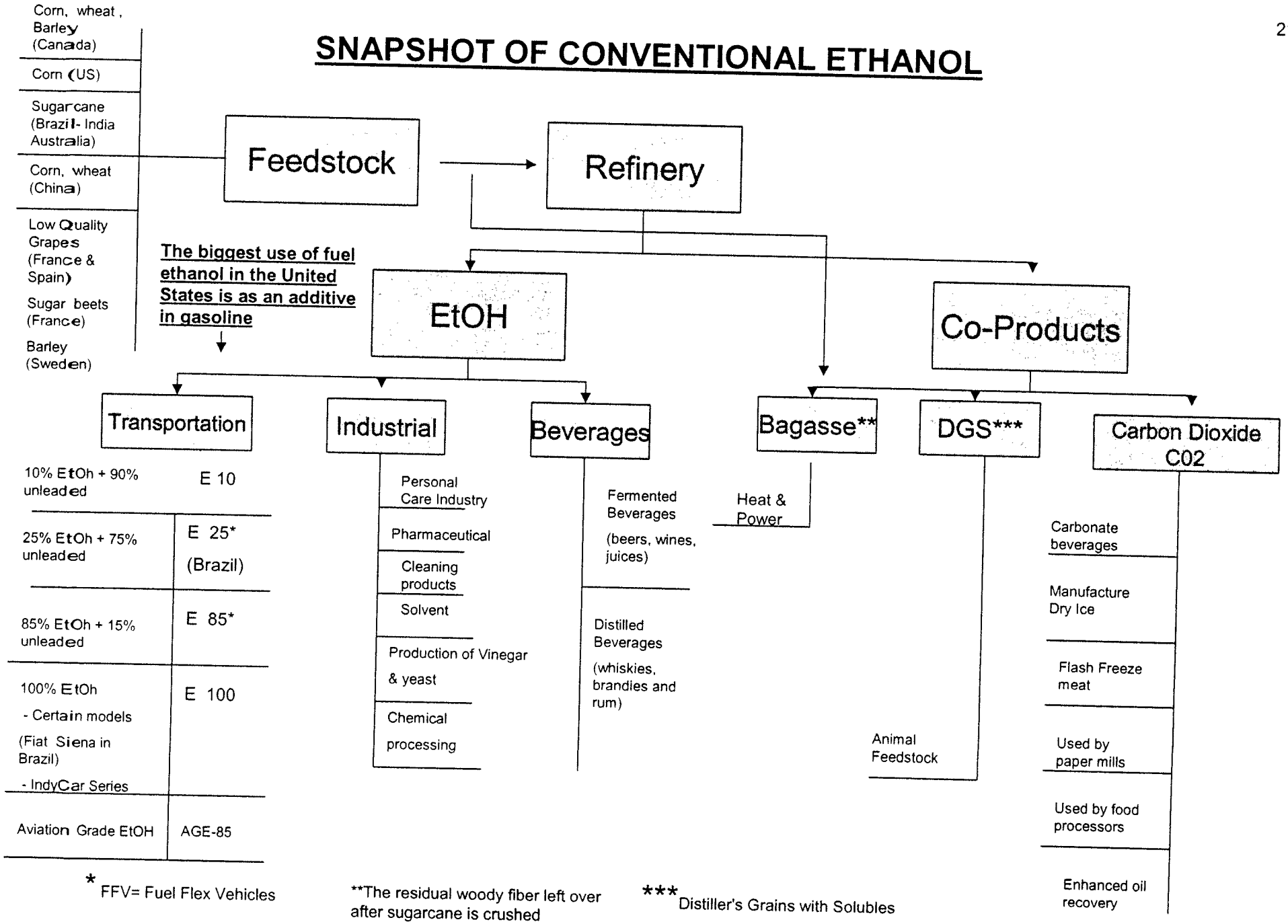
State Strengths	Cluster Opportunities	Projected Launch (1st Meeting Date)
Auto R&D	Cellulosic BioFuel (Forestry)	April 20th, 2007
Auto Mfg	Wind	June 13, 2007
Advanced Mfg (Non Auto)	Photovoltaic (Solar)	Fall 2007
Agriculture	Advanced Battery	Fall 2007
Trad Mfg	Health Technologies	Fall 2007
Forestry		

The following pages on Cellulosic ethanol are not part of this presentation, but are included as examples of the past and ongoing research to support the cluster efforts

KEY VARIABLES IN THE CelEtOH VALUE CHAIN



SNAPSHOT OF CONVENTIONAL ETHANOL



* FFV= Fuel Flex Vehicles

**The residual woody fiber left over after sugarcane is crushed

*** Distiller's Grains with Solubles

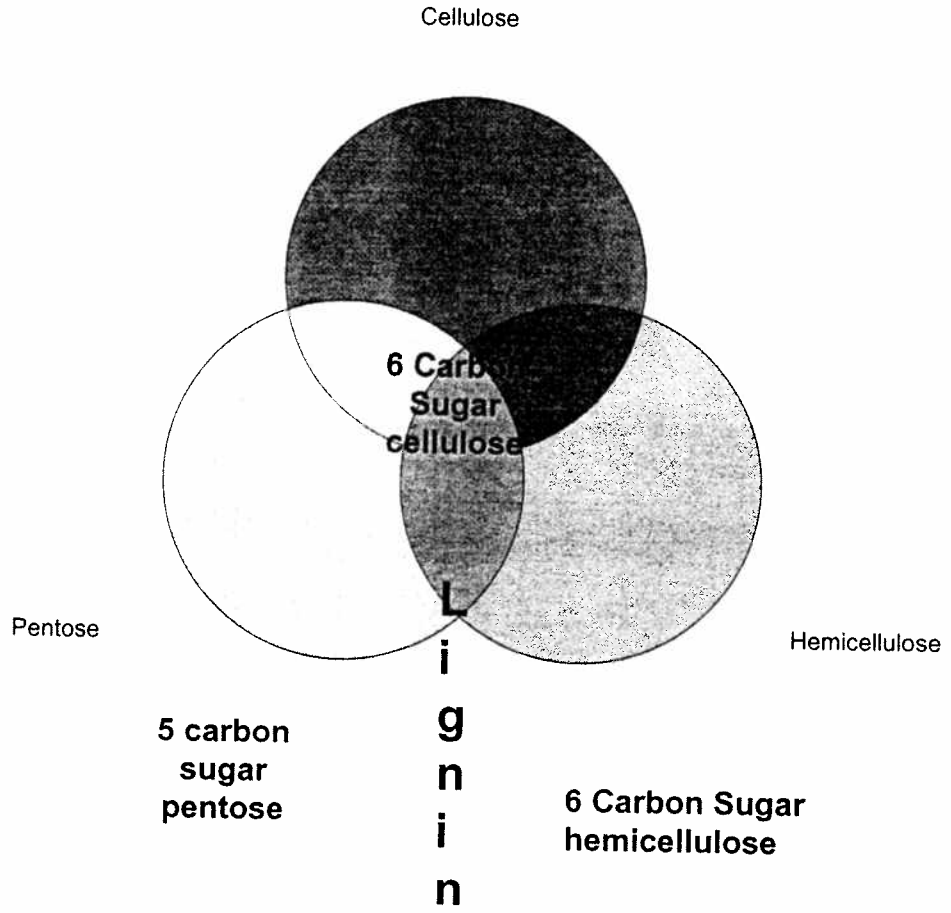
Leading Ethanol Producers in the U.S. (2006)

Company	US Locations by State
Archer Daniels Midland (ADM)	IL, IA, NE,MN,ND
VeraSun Energy	SD, IA
Hawkeye Renewables	IA
Aventine Renewable Energy	IL, NE
Cargill, Inc.	NE, IA
Abengoa Bioenergy	NE,KS,NM
New Energy Corp.	IN
Global Ethanol/Midwest	IA, MI

Solomon BD, et al. Grain and cellulosic ethanol: History, economics, and energy policy. Biomass and Bioenergy (2007), doi:10.1016/j.biombioe.2007.01.023

CelEtOH is more complex to produce than EtOH

Biomass Cellulose is more complex because biomass sugar is <u>not</u> of the same variety. In fact, it is composed by 6 carbon glucose of sugar in the form of cellulose + 5 carbon sugar pentose linked to 6 carbon sugars in the form of hemicellulose bound together by complex chemical bonds bound by a stiff and fibrous substance called **lignin.**



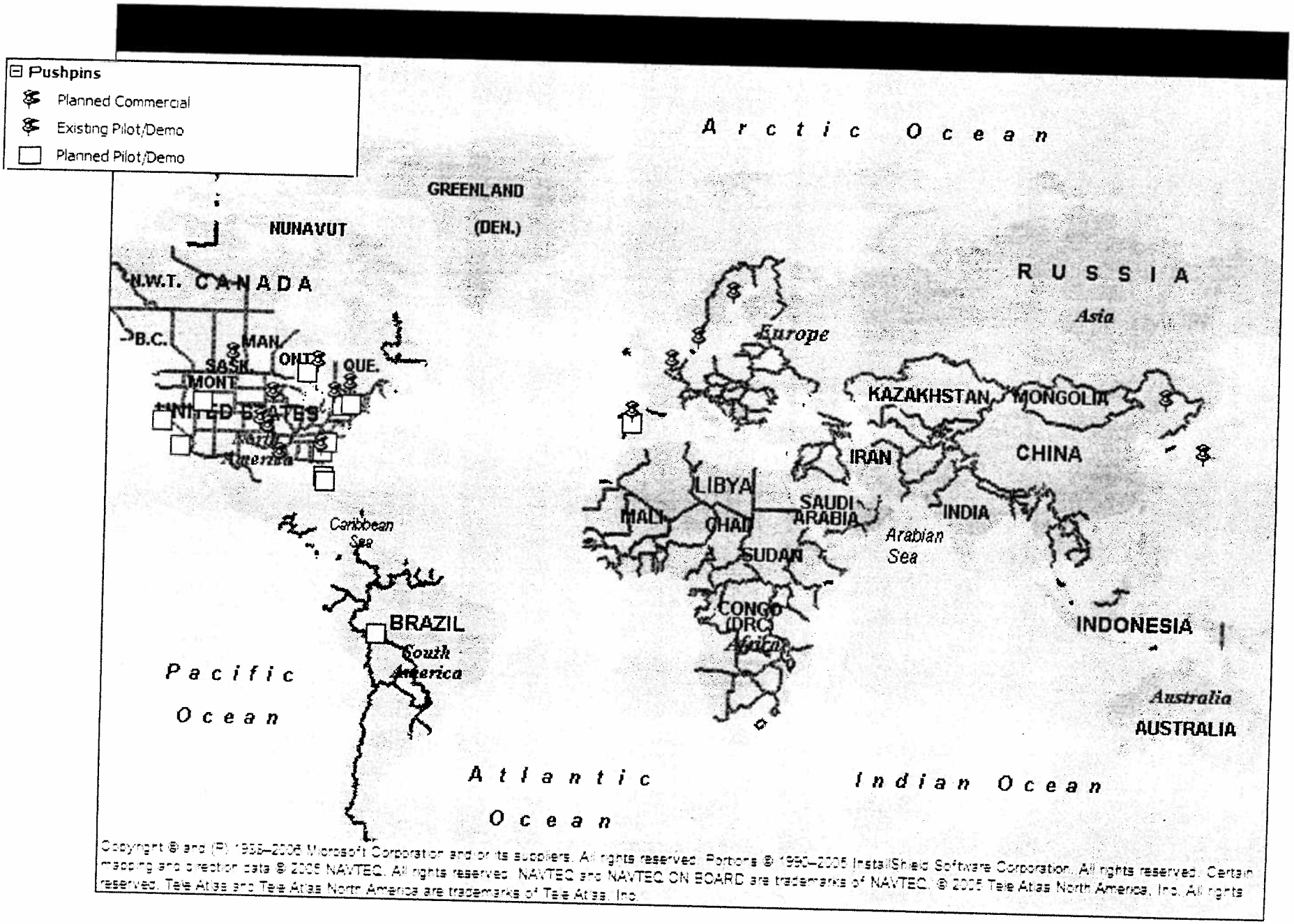
- Cellulosic Sugar biomass is more complex than the one found in conventional feedstock.
- Sugar in corn grain is of the same variety.
- More specifically, biomass Cellulose is more complex because biomass sugar is not of the same variety.
- Accordingly, in a CelEtOH biorefinery the biomass feedstock must first be pretreated to separate the ligning from the feedstock and loosen up the chemical bonds. Then, (in the hydrolysis approach) special enzyme are applied to breakdown the complex sugar to sugar bonds.

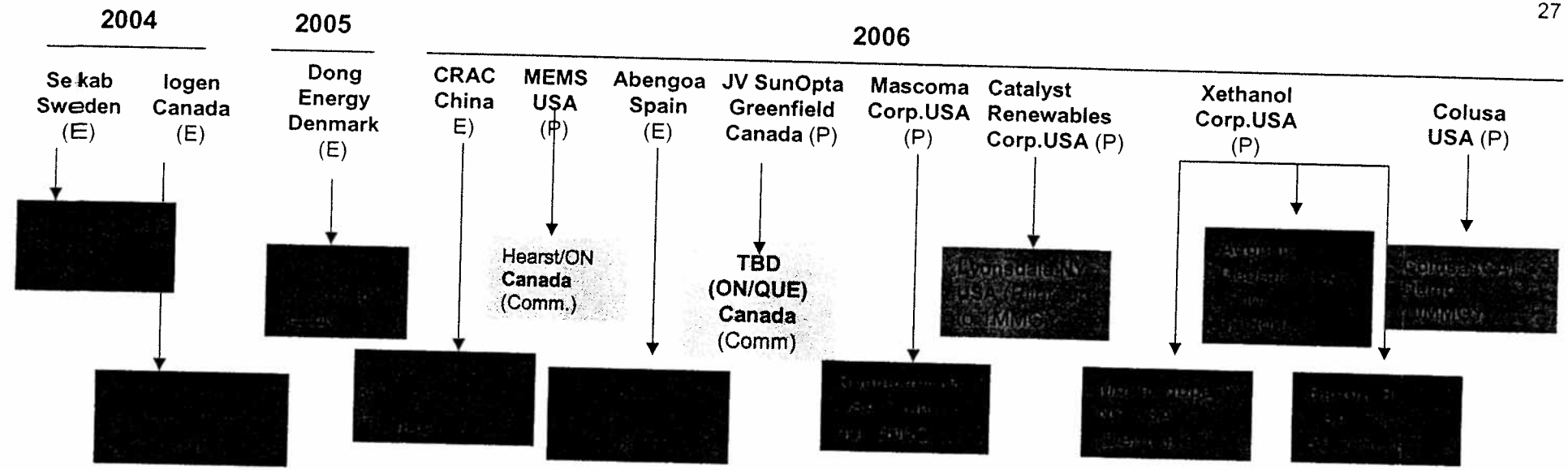
CelEtOH Plant Location Analysis
Methodology

- Identify Companies and corresponding (existing and planned) CelEtOH plant locations;
- Identify pilots, demonstration and commercials plants;
- Identify Company Core Competencies;
- Identify science/technology strategic alliances;
- Identify predominant company science/technology strategic alliances;
- Identify predominant country science/technology strategic alliances;
- Identify type of biomass conversion per each plant;
- Identify university connections;
- Identify DOE and State RFP Awardees;
- Identify international companies;
- Identify major companies;
- Identify leading companies by category;
- Identify key behind the scenes players;
- Identify company nationality and country/state of plant location;
- Identify site-location factors;
- Research certain key strategic alliances within this pool of companies;
- Cross-compare data above;
- Identify location trends;
- Identify leading companies positioning themselves in CelEtOH by category
- Identify best company targets among this pool of companies.
- Develop some preliminary general observations and recommendations for further evaluation by the cluster council.
- Continuously update data and findings by monitoring sector activity.

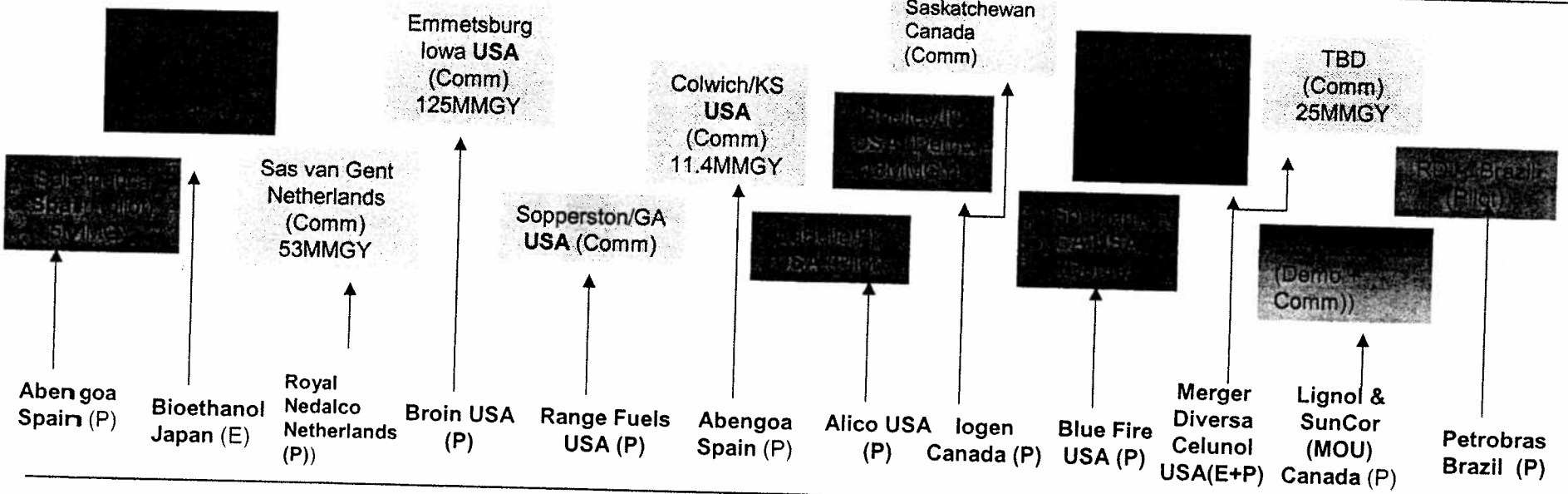
Inventory of Plants

- Plants: 29
- Pilot/Demos plants: 20, of which
  - 7 Existing and 13 Planned
- Planned commercial plants: 9
- Companies: 20
- U.S. Companies: 10
- Foreign Companies: 10, of which (1) Brazil; (4) Canada; (1) Denmark; (1) Japan; (1) Netherlands(1) PRC; (1) Spain.
- Obviously, no existing commercial plants yet; earliest estimate for a commercial plant is for 2009.
- Initially, International companies held the lead, but U.S. companies are starting to catch up.
- 10 Plants: Agro Biomass
- 10 Plants: Wood Biomass
- 6 Plants: Agro/Wood Biomass
- 3 Plants unspecified

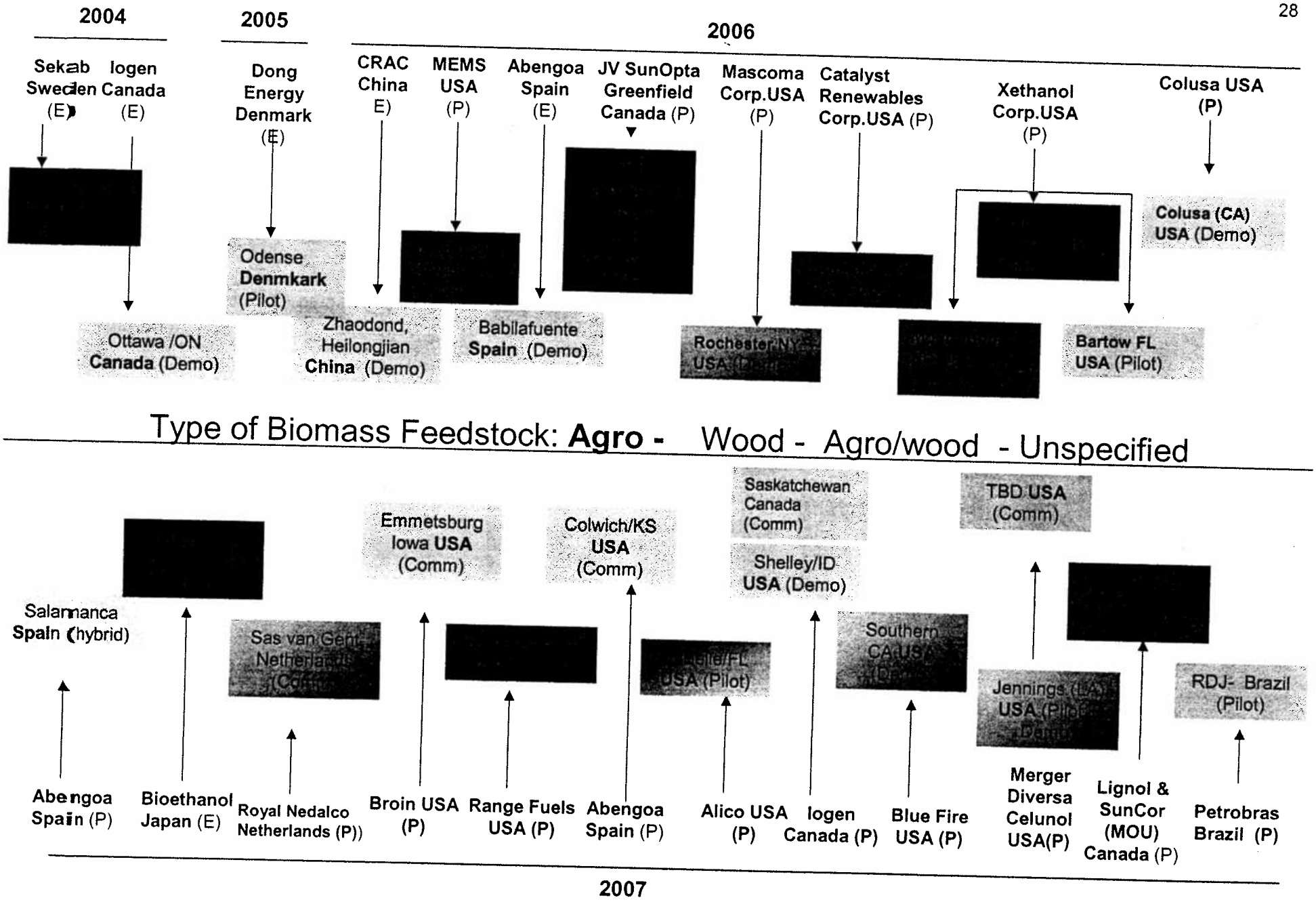


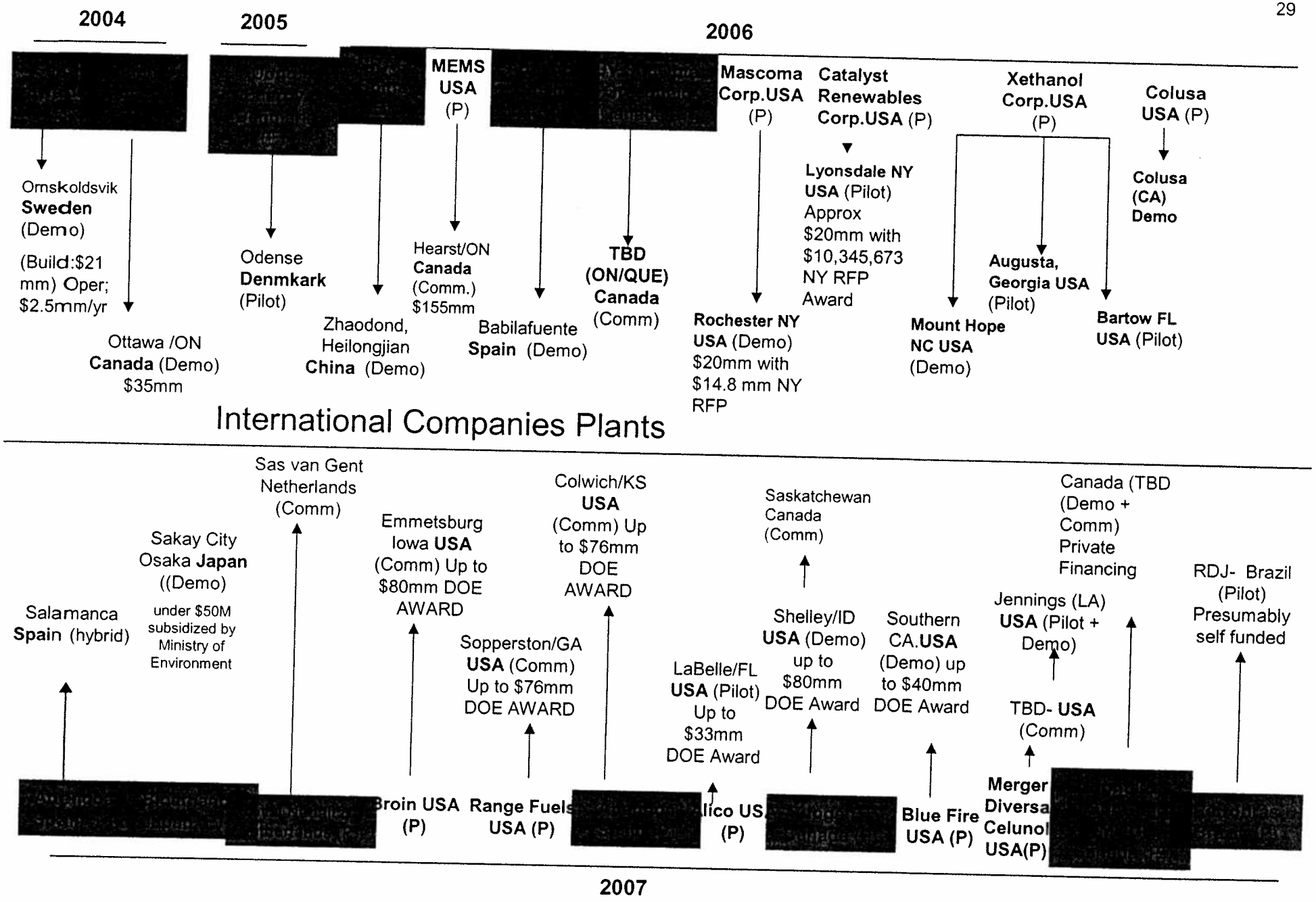


Plants: **Existing Pilot/Demo; Planned Pilot/ Demo; Planned Commercial**



2007


2004
2005
2006
Sekab Sweden (E)
Iogen Canada (E)
Dong Energy Denmark (E)
CRAC China E)
MEMS USA (P)
Abengoa Spain (E)
JV SunOpta Greenfield Canada (P)
Mascoma Corp.USA (P)
Catalyst Renewables Corp.USA (P)
Xethanol Corp.USA (P)
Colusa USA (P)
Colusa (CA) USA (Demo)
Odense Denmkark (Pilot)
Ottawa /ON Canada (Demo)
Zhaodond, Heilongjian China (Demo)
Babilafuente Spain (Demo)
Rochester NY USA (D
Bartow FL USA (Pilot)
Type of Biomass Feedstock: Agro - Wood - Agro/wood - Unspecified
Saskatchewan Canada (Comm)
TBD USA (Comm)
Emmetsburg Iowa USA (Comm)
Colwich/KS USA (Comm)
Shelley/ID USA (Demo)
Salamanca Spain (hybrid)
Sas van Gent Netherlands (Co
Southern CA USA (D
Jennings (LA) USA (Pilot Plant)
RDJ- Brazil (Pilot)
Abengoa Spain (P)
Bioethanol Japan (E)
Royal Nedalco Netherlands (P))
Broin USA (P)
Range Fuels USA (P)
Abengoa Spain (P)
Alico USA (P)
Iogen Canada (P)
Blue Fire USA (P)
Merger Diversa Celunol USA(P)
Lignol & SunCor (MOU) Canada (P)
Petrobras Brazil (P)
2007


2004
2005
2006
MEMS USA (P)
Mascoma Corp.USA (P)
Catalyst Renewables Corp.USA (P)
Xethanol Corp.USA (P)
Colusa USA (P)
Omskoldsvik Sweden (Demo)
(Build:$21 mm) Oper; $2.5mm/yr
Ottawa /ON Canada (Demo) $35mm
Odense Denmkark (Pilot)
Zhaodond, Heilongjian China (Demo)
Hearst/ON Canada (Comm.) $155mm
Babilafuente Spain (Demo)
TBD (ON/QUE) Canada (Comm)
Rochester NY USA (Demo) $20mm with $14.8 mm NY RFP
Lyonsdale NY USA (Pilot) Approx $20mm with $10,345,673 NY RFP Award
Mount Hope NC USA (Demo)
Augusta, Georgia USA (Pilot)
Bartow FL USA (Pilot)
Colusa (CA) Demo
International Companies Plants
Salamanca Spain (hybrid)
Sakay City Osaka Japan ((Demo)
under $50M subsidized by Ministry of Environment
Sas van Gent Netherlands (Comm)
Emmetsburg Iowa USA (Comm) Up to $80mm DOE AWARD
Sopperston/GA USA (Comm) Up to $76mm DOE AWARD
Colwich/KS USA (Comm) Up to $76mm DOE AWARD
LaBelle/FL USA (Pilot) Up to $33mm DOE Award
Saskatchewan Canada (Comm)
Shelley/ID USA (Demo) up to $80mm DOE Award
Southern CA.USA (Demo) up to $40mm DOE Award
Jennings (LA) USA (Pilot + Demo)
TBD- USA (Comm)
Canada (TBD (Demo + Comm) Private Financing
RDJ- Brazil (Pilot) Presumably self funded
Broin USA (P)
Range Fuels USA (P)
Blue Fire USA (P)
Merger
Diversa
Celunol
USA(P)
2007

How to identify serious CelEtOH players

Serious Players	**Potential Players**	**Weak Players**
(1) Have existing Pilot Plant, or	Primary locators	No direct or indirect sector-related core competencies
(2) Have obtained government CelEtOH funding, or	Co-locators	Have not attracted VC
(2) Have attracted VC funds;	Technology Enablers	Do not invest directly or indirectly in CelEtOH R&D
And	Behind the Scene players	Be especially wary of those that:
(a) Have in-house enabling technologies; or	Financing Enablers	(a) have made grandiose plants announcements with all of the above in this column place; and/or
(b) Have CelEtOH strategic alliances in place with partners that have demonstrated CelEtOH experience	Providers of large volumes of biomass feedstock	(b) claim CelEtOH competencies via strategic alliances with companies that purport to have CelEtOH experience (with no demonstrated experience)

NB: These factors can be turned into questions for the purpose of vetting inquiries